

WHAT IS CLAIMED IS:

1. A urethane acrylate gel coat resin comprising reaction products of a reaction mixture comprising
 - (a) a hydroxy-terminated oligoester having weight average molecular weight of about 200 to about 4000;
 - (b) a diisocyanate; and
 - (c) a hydroxyalkyl (meth)acrylate.
2. The gel coat resin of claim 1 comprising a compound having an idealized structure C-B-A-B-C,
wherein A is the oligoester, B is the diisocyanate, and C is the hydroxyalkyl (meth)acrylate.
3. The resin of claim 1 wherein the oligoester is saturated or unsaturated and has a weight average molecular weight of about 500 to about 3000.
4. The gel coat resin of claim 1 wherein the oligoester is a reaction product of (a) a saturated diol and an optional saturated triol, and (b) a saturated or an unsaturated dicarboxylic acid, a saturated or unsaturated dicarboxylic acid anhydride, or mixtures thereof.

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5. The gel coat resin of claim 4 wherein the diol and triol are selected from the group consisting of 1,6-hexanediol, neopentyl glycol, trimethylolpropane, 1,3-butylene glycol, 1,4-butylene glycol, cyclohexanedimethanol, ethylene glycol, propylene glycol, pinacol, pentanediol, 2,2-dimethyl-1,3-propanediol, isopropylidene bis(p-phenyleneoxypropanol-2), a polyethylene or polypropylene glycol having a weight average molecular weight of about 500 or less, and mixtures thereof.

6. The gel coat resin of claim 5 wherein the dicarboxylic acid is selected from the group consisting of adipic acid, maleic acid, malonic acid, cyclohexanedicarboxylic acid, sebacic acid, azelaic acid, succinic acid, glutaric acid, pimelic acid, suberic acid, chlorosuccinic acid, maleic acid, dihydroxymaleic acid, diglycollic acid, oxalic acid, oxalic acid, pimelic acid, suberic acid, chlorosuccinic acid, mesoxalic acid, acetone dicarboxylic acid, dimethyl malonic acid, 1,2-cyclopropanedicarboxylic acid, cyclobutane-1,1-dicarboxylic acid, cyclobutane-1,2-dicarboxylic acid, cyclobutane-1,3-dicarboxylic acid, cyclopentane-1,1-dicarboxylic acid, cyclopentane-1,2-dicarboxylic acid, 2,5-dimethylcyclopentane-1,1-dicarboxylic acid, alpha, alpha'-di-sec-butylglutaric acid, beta-methyl-adipic acid, isopropyl-succinic acid, and 1,1-dimethyl-succinic acid, anhydrides thereof, and mixtures thereof.

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7. The gel coat resin of claim 1 wherein a reaction mixture of (a), (b), and (c) contains a molar ratio of about 0.75 to about 1.25 mole (a) to about 1.5 to about 2.5 moles (b) to about 1.5 to about 2.5 moles (c).

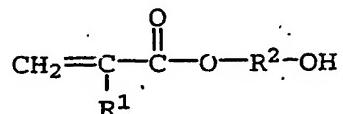
8. The gel coat resin of claim 1 wherein the diisocyanate comprises (a) an aliphatic diisocyanate and (b) up to 20% of an aromatic diisocyanate, by total weight of the diisocyanate.

9. The gel coat resin of claim 8 wherein the aliphatic diisocyanate is selected from the group consisting of 1,6-hexamethylene diisocyanate, isophorone diisocyanate, 1,4-cyclohexane diisocyanate, 2,4'-dicyclohexylmethane diisocyanate, 4,4'-dicyclohexylmethane diisocyanate, 1,3-bis(isocyanatomethyl)cyclohexane, 1,4-bis(isocyanatomethyl)cyclohexane, tetramethylxylylene diisocyanate, 1,11-diisocyanatoundecane, 1,12-diisocyanatododecane, 2,2,4-trimethyl-1,6-diisocyanatohexane, 2,4,4-trimethyl-1,6-diisocyanatohexane, 1,2-bis(isocyanatomethyl)cyclobutane, hexahydro-2,4-diisocyanatotoluene, hexahydro-2,6-diisocyanatotoluene, 1-isocyanato-2-isocyanatomethyl cyclopentane, 1-isocyanato-3-isocyanatomethyl-3,5,5-trimethyl cyclohexane, 1-isocyanato-4-isocyanatomethyl-1-methyl cyclohexane, 1-isocyanato-3-isocyanatomethyl-1-methyl cyclohexane, and mixtures thereof.

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10. The gel coat resin of claim 9 comprising 0% to about 20%, by total weight of the diisocyanate, of an aromatic diisocyanate selected from the group consisting of toluene 2,4-diisocyanate, toluene 2,6-diisocyanate, 4,4'-methylene-diphenyl diisocyanate, 2,4'-methylene diphenyl diisocyanate, polymeric methylene diphenyl diisocyanate, p-phenylene diisocyanate, naphthalene-1,5-diisocyanate, and mixtures thereof.

11. The gel coat resin of claim 1 wherein the hydroxyalkyl (methyl)acrylate has a structure



wherein R¹ is hydrogen or methyl and R² is a C₁ to C₆ alkylene group or an arylene group.

12. The gel coat resin of claim 1 wherein the hydroxyalkyl (meth)acrylate is selected from the group consisting of 2-hydroxyethyl methacrylate, 2-hydroxyethyl acrylate, 2-hydroxypropyl methacrylate, 3-hydroxypropyl methacrylate, and mixtures thereof.

13. The gel coat resin of claim 1 wherein the oligoester comprises a reaction of product of (a) neopentyl glycol, 1,6-hexanediol, or a mixture thereof, and (b) adipic acid.

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14. The gel coat resin of claim 13 wherein the diisocyanate comprises isophorone diisocyanate.

15. The gel coat resin of claim 14 wherein the hydroxyalkyl (meth)acrylate comprises 2-hydroxyethyl acrylate.

16. A gel coat composition comprising a urethane acrylate gel coat resin of claim 1.

17. The gel coat composition of claim 16 wherein the gel coat resin is present in the composition in an amount of about 25% to about 50%, by weight, of the composition.

18. The gel coat composition of claim 16 further comprising a pigment paste, a free radical initiator, or a mixture thereof.

19. A gel coat prepared by curing a gel coat composition comprising a urethane acrylate gel coat resin of claim 1.

20. The gel coat of claim 19 wherein the gel coat is prepared by a free radical polymerization.

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21. An article of manufacture having an exterior gel coat prepared by curing a gel coat composition comprising a urethane acrylate gel coat resin of claim 1.

22. A method of preparing a urethane acrylate gel coat resin comprising the steps of

(a) preparing a hydroxy-terminated oligoester having a weight average molecular weight of about 200 to about 4000 by reacting (i) a saturated diol and optional saturated triol with (ii) a saturated or unsaturated dicarboxylic acid, a saturated or unsaturated dicarboxylic acid anhydride, or a mixture thereof, in sufficient relative amounts of (i) and (ii) to provide terminal hydroxy groups;

(b) adding a hydroxyalkyl (meth)acrylate to the oligoester of step (a) to form a prereaction mixture;

(c) then adding a diisocyanate to the prereaction mixture of step (b) to form a reaction mixture; and

(d) maintaining the reaction mixture of step (c) at a sufficient temperature for a sufficient time to react essentially all isocyanate moieties of the diisocyanate and yield the urethane acrylate gel coat resin.

23. The method of claim 22 wherein the gel coat resin has an acrylate group positioned at each terminal end of the resin.

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24. The method of claim 23 wherein the gel coat resin is prepared using a molar ratio of (I) oligoester to (II) diisocyanate to (III) hydroxyalkyl (meth)acrylate of about 0.9 to about 1.1 (I) to about 1.5 to about 2.2 (II) to about 1.5 to about 2.2 (III).

25. The method of claim 23 wherein the gel coat resin is prepared using a mole ratio of oligoester to diisocyanate to hydroxyalkyl (meth)acrylate of 1:1.7-2:1.7-2, respectively.